

T15D13 – Spontaneity IB Practice

Name.....

1. Under what circumstances is a reaction spontaneous at all temperatures?

	ΔH^\ominus	ΔS^\ominus
A.	+	+
B.	+	–
C.	–	–
D.	–	+

(Total 1 mark)

2. The ΔH^\ominus and ΔS^\ominus values for a certain reaction are both positive. Which statement is correct about the spontaneity of this reaction at different temperatures?

- A. It will be spontaneous at all temperatures.
 B. It will be spontaneous at high temperatures but not at low temperatures.
 C. It will be spontaneous at low temperatures but not at high temperatures.
 D. It will not be spontaneous at any temperature.

(Total 1 mark)

3. For a certain reaction at 298 K the values of both ΔH^\ominus and ΔS^\ominus are negative. Which statement about the sign of ΔG^\ominus for this reaction must be correct?

- A. It is negative at all temperatures.
 B. It is positive at all temperatures.
 C. It is negative at high temperatures and positive at low temperatures.
 D. It cannot be determined without knowing the temperature.

(Total 1 mark)

4. The following reaction is spontaneous only at temperatures above 850°C.



Which combination is correct for this reaction at 1000°C?

	ΔG	ΔH	ΔS
A.	–	–	–
B.	+	+	+
C.	–	+	+
D.	+	–	–

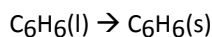
(Total 1 mark)

5. Explain in terms of ΔG^\ominus , why a reaction for which both ΔH^\ominus and ΔS^\ominus are positive is sometimes spontaneous and sometimes not.

.....

(Total 4 marks)

6. For the process:



the standard entropy and enthalpy changes are:

$$\Delta H^\ominus = -9.83 \text{ kJ mol}^{-1} \text{ and } \Delta S^\ominus = -35.2 \text{ J K}^{-1} \text{ mol}^{-1}.$$

Predict and explain the effect of an increase in temperature on the spontaneity of the process.

.....

(Total 3 marks)

7. The standard enthalpy change for the combustion of phenol, $\text{C}_6\text{H}_5\text{OH}(\text{s})$, is $-3050 \text{ kJ mol}^{-1}$ at 298 K.

(a) Write an equation for the complete combustion of phenol.

.....
.....

(1)

(b) The standard enthalpy changes of formation of carbon dioxide, $\text{CO}_2(\text{g})$, and of water, $\text{H}_2\text{O}(\text{l})$, are -394 kJ mol^{-1} and -286 kJ mol^{-1} respectively.

Calculate the standard enthalpy change of formation of phenol, $\text{C}_6\text{H}_5\text{OH}(\text{s})$.

.....
.....
.....
.....
.....
.....
.....

(3)

(c) The standard entropy change of formation, ΔS^\ominus , of phenol, $\text{C}_6\text{H}_5\text{OH}(\text{s})$ at 298 K is $-385 \text{ J K}^{-1} \text{ mol}^{-1}$. Calculate the standard free energy change of formation, ΔG^\ominus , of phenol at 298 K.

.....
.....
.....
.....
.....
.....
.....

(3)

(d) Determine whether the reaction is spontaneous at 298 K, and give a reason.

.....
.....
.....
.....

(2)

(e) Predict the effect, if any, of an increase in temperature on the spontaneity of this reaction.

.....
.....
.....
.....

(2)

(Total 11 marks)